REMARKS

Claims 1-22, 35 and 40-48 were previously pending for examination. Claims 1, 12, 35, 40, and 41 are currently amended. New claims 54-56 are currently added. Support for these amendments and new claims can be found, for example, in FIG. 2 and paragraph [0060] of the application as published (U.S. Patent Pub. No. 2007/0007214 A1). Claims 4, 5, 15, and 16 are currently canceled without prejudice or disclaimer. As a result, claims 1, 3, 6-14, 17-22, 35, 40-48, and 54-56 are currently pending for examination, with claims 1, 12, 35, 40, and 41 being independent claims. No new matter has been added.

Rejections under 35 U.S.C. § 102

Claims 1-6, 8-17, 19-22, 35 and 40-42 were rejected under 35 U.S.C. § 102(b) as anticipated by Heine et al. (US 6,126,819) (hereinafter "Heine").

Claims 1-22, 35 and 40-48 were rejected under 35 U.S.C. § 102(b) as anticipated by Zha et al. (US 2001/0047962) (hereinafter "Zha").

Applicants respectfully disagree with these grounds for rejection.

Applicants note that claims 4, 5, 15, and 16 have been cancelled, rendering the rejection of these claims moot.

Neither Heine nor Zha can anticipate any of independent claims 1, 12, 35, 40, or 41 or the claims that depend therefrom because both Heine and Zha fail to disclose a gas inlet as recited in these claims.

Heine discloses that "the [membrane filtration] apparatus preferably also includes means for admitting air thereto" (Heine at Col. 5, lines 63-65) and that "air is supplied to the interior 24 of the apparatus 10 at certain time intervals [and] may be supplied separately or together with the liquid medium 11" (Heine at Col. 9, lines 23-25). However, Heine discloses no structure, location, or arrangement for the "means for admitting air."

Zha discloses a membrane filtration module in which a "venturi device 12 intakes gas through inlet 13 [and] mixes or entrains the gas with liquid flowing through feed inlet 14" (Zha at paragraph [0041]). In all of the embodiments of the membrane filtration module disclosed in Zha, an air inlet integral to a wall of a venturi device 12 (Zha at FIG.1) or jet assembly chamber 16, 57 (Zha at FIGS. 2 and 9) is disclosed as introducing air from a side of the membrane filtration module and perpendicular to a flow of feed from a feed inlet.

As such, neither Heine nor Zha can anticipate a membrane module or an assembly of membrane modules comprising a chamber including "a gas inlet constructed and arranged to

introduce gas into said chamber in a downward direction from above [an]open base end" as recited in amended independent claims 1 and 12, respectively. For similar reasons, neither Heine nor Zha can anticipate a membrane module comprising "a gas source positioned within [an] open-ended mixing chamber, the gas source constructed and arranged to introduce gas into the open-ended mixing chamber in a downward direction from above [an] open base" as recited in amended independent claim 35, a membrane module or assembly of membrane modules for use in a membrane bioreactor comprising "a gas inlet positioned within [an] open-ended mixing chamber, the gas inlet spaced from and surrounded by side walls of the open-ended mixing chamber" as recited in amended independent claims 40, or an assembly of membrane modules for use in a membrane bioreactor comprising "a gas inlet positioned within [an] open-ended mixing chamber, the gas inlet spaced from and surrounded by side walls of the open-ended mixing chamber, and centrally located within the open-ended mixing chamber" as recited in amended independent claim 41.

Dependent claims 2, 3, 6, 8-11, 13, 14, 17, 19-22, and 42 all depend either directly or indirectly from at least one of independent claims 1, 12, 35, 40, or 41 and cannot be anticipated by Heine for at least the same reasons as independent claims 1, 12, 35, 40, and 41.

Dependent claims 2, 3, 6-11, 13, 14, 17-22, and 42-48 all depend either directly or indirectly from at least one of independent claims 1, 12, 35, 40, or 41 and cannot be anticipated by Zha for at least the same reasons as independent claims 1, 12, 35, 40, and 41.

Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6, 8-14, 17, 19-22, 35 and 40-42 under 35 U.S.C. § 102 as anticipated by Heine and the rejection of claims 1-22, 35 and 40-48 under 35 U.S.C. § 102 as anticipated by Zha is respectfully requested.

Rejections under 35 U.S.C. § 103

Claims 1-22, 35 and 40-48 were rejected under 35 U.S.C. § 103(a) over Heine and/or Zha and further in view of Henshaw (US 5,783,083). Applicants respectfully disagree with this ground for rejection.

Applicants note that claims 4, 5, 15, and 16 have been cancelled, rendering the rejection of these claims moot.

The Examiner relies on Henshaw for teaching a "plurality of submerged membrane modules arranged in manifolds to have enlarged capacity treatment systems." Even if Henshaw discloses this, there is no *prima facie* case of obviousness over Heine and/or Zha in view of

Henshaw. One of ordinary skill in the art would not have been motivated to have combined either Heine or Zha with Henshaw. Even if combined, no alleged combination of Heine and/or Zha with Henshaw could have taught each and every element of any of claims 1-3, 6-14, 17-22, 35, and 40-48.

One of ordinary skill in the art would not have been motivated to have combined Heine and Henshaw because any combination would have required a fundamental change in the design and operation of the disclosed apparati. Heine discloses a cross flow membrane filtration system wherein, in operation, feed constantly flows through the system. (Heine at Col. 2, lines 46-56.) In contrast, Henshaw discloses a dead end filtration system wherein permeate is extracted from a captive bath of feed. (Henshaw at Col. 6, lines 33-35, 57-60; Col. 10, lines 42-47.) These two modes of operation are fundamentally different. Heine could not have been combined with Henshaw without a fundamental redesign to the structure and operation of the system of Heine or that of Henshaw. For example, the membrane fibers of Henshaw are not confined within a modular shell. (Henshaw at Col. 7, lines14-15.) A cross-flow filtration system as disclosed in Heine could not operate without confining the fiber membranes within some sort of shell to direct flowing feed past the membranes. Further, Henshaw discloses that an advantage of the disclosed apparatus is to "minimize excessive abrasion between fibers." (Henshaw at Col. 1, lines 44-50.) Henshaw accomplishes this by holding the membrane fibers in place between an upper and a lower header spaced apart from each other by a sufficient length to prevent the membrane fibers from moving significantly and contacting one another. (Henshaw at Col. 6, lines 38-41; Col. 11, lines 45-47.) This advantage could not be realized if the fiber arrangement in Henshaw was modified to be similar to that disclosed in Heine in which one end of the membrane fibers are not restrained. As such, one of ordinary skill in the art would not have been motivated to have combined Heine and Henshaw.

One of ordinary skill in the art would not have been motivated to have combined Zha and Henshaw because any combination would require a fundamental change in the design and operation of the disclosed apparati. Further, any combination would eliminate one of the advantages of the apparatus disclosed by Zha. Zha discloses a membrane filtration module with either a venturi device 12 (Zha at FIG. 1) or a jet assembly 57 (Zha at FIG. 9) for entraining a gas with liquid flowing through feed an inlet 14. Zha discloses that an advantage of this arrangement is to make it "possible to create gas bubbles and aerate the system without a blower" because "[w]hen a motive fluid passes through a venturi it generates a vacuum to draw

the gas into the liquid flow and generate gas bubbles therein" (Zha at paragraphs [0041] and [0045]). In contrast, the sparger 40 of Heine is supplied with air (presumably pressurized air) through air feed tube 44. To include a venturi device as disclosed in Zha into the apparatus of Heine would require a fundamental redesign to the apparatus and would significantly alter its method of operation. To include the sparger of Henshaw in the filtration module of Zha would fundamentally alter the operating principle of the filtration module and would eliminate one of the disclosed advantages thereof. As such, one of ordinary skill in the art would not have been motivated to have combined Zha and Henshaw.

Even if combined, no alleged combination of Zha and/or Heine with Henshaw could have disclosed, taught, or suggested "a gas inlet constructed and arranged to introduce gas into [a] chamber [of a membrane filtration module] in a downward direction" as recited in each of independent claims 1, 12, and 35. The alleged combination would also have failed to disclose, teach, or suggest "a gas inlet positioned within [an] open-ended mixing chamber [positioned below a lower potting head], the gas inlet spaced from and surrounded by side walls of the open-ended mixing chamber" as recited in each of independent claims 40 and 41. The gas inlet of Zha is disclosed as integral to the side wall of the venturi chamber 12 of Zha and is configured to introduce gas horizontally into an upwardly flowing stream of liquid. The gas distribution means of Henshaw is located above and in close proximity to the upper face of the lower header of the membrane filtration assembly and introduces gas either upwardly or horizontally into the assembly. Any alleged combination of Zha and Henshaw would have resulted in a membrane filtration apparatus with a gas inlet which supplied gas either upwardly or horizontally from either a side wall or from above a potting head of the assembly. Heine discloses no structure or location for a gas supply means, and thus any combination of Heine with Henshaw would have resulted in a membrane filtration apparatus with a gas inlet which supplied gas either upwardly or horizontally from above a potting head of the assembly. Thus, Henshaw fails to cure the deficiencies identified above with respect to both Heine and Zha. Henshaw does not disclose, teach, or suggest a gas inlet as recited in any of claims 1-3, 6-14, 17-22, 35, and 40-48.

As such, each of claims 1-3, 6-14, 17-22, 35, and 40-48 is patentable over any alleged combination of Heine and/or Zha with Henshaw. Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6-14, 17-22, 35, and 40-48 under 35 U.S.C. § 103 over Heine and/or Zha in view of Henshaw is respectfully requested.

Provisional Double Patenting Rejection

Claims 1-22, 35 and 40-48 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over the claims in co-pending Application No. 11/025,418. Applicants respectfully disagree that any of claims 1-22, 35 and 40-48 of the instant application should be rejected on the ground of obviousness-type double patenting. Notwithstanding this traversal, Applicants will submit a terminal disclaimer with respect to co-pending Application No. 11/025,418 once the instant claims are deemed allowable.

New Claims

New claims 54 and 55 depend either directly or indirectly from independent claim 1 and are patentable over Zha, Heine, and Henshaw for at least the same reasons as independent claim 1. Notably, none of Zha, Heine, and Henshaw, alone or in combination, disclose, teach, or suggest a "gas inlet [that] is fluidly connected to a source of gas within [a membrane filtration] chamber" as recited in new claims 54 and 55. New claim 56 depends directly from independent claim 12 and is patentable over Zha, Heine, and Henshaw for at least the same reasons as independent claim 12. Notably, none of Zha, Heine, and Henshaw, alone or in combination, disclose, teach, or suggest a "gas inlet [that] is fluidly connected to a source of gas positioned among the plurality of porous membranes" in an assembly of membrane filtration modules, as is recited in new claim 56.

CONCLUSION

Applicants respectfully request reconsideration of the claims in view of the foregoing amendments and remarks. The application as presented is in condition for allowance. An early and favorable action is respectfully requested. If the Examiner believes, after this Response, that the application is not in condition for allowance, the Examiner is invited to call Applicants' representative at the telephone number listed below.

If this Response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed payment, please charge any deficiency to Deposit Account No. 50/2762 (Ref. No. M2019-7027US).

Respectfully submitted,
Fufang Zha et al., *Applicants*

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